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‘Road rage’ in Arizona: armed and dangerous

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Abstract

Little is known about the relationship between firearm carrying and hostile behavior on the roadway. To explore a possible association between firearm carrying by drivers and hostile driving behavior we conducted a random-digit-dial survey of 790 licensed drivers in Arizona. In addition to demographic questions, we asked whether respondents had carried a gun while driving in the 12 months prior to the survey. Respondents were also asked if they, in anger, had personally made obscene gestures, cursed or shouted at other drivers, impeded another drivers progress with their vehicle, aggressively ‘followed another driver too closely’, or brandished a gun at another driver. We used multivariable logistic regression to explore correlates of hostile driving behavior while taking into account several demographic and behavioral characteristics. Overall 11% of drivers always (4%) or sometimes (7%) carried a gun with them in their vehicle; 34% report having made obscene gestures/cursed/shouted angrily; 28% report aggressively following or blocking other drivers with their vehicle. In both crude and multivariate adjusted analyses, self-report of engaging in hostile behavior while driving was significantly more common among men, young adults, and individuals who carried a firearm in their car. Our findings suggest that, at least among Arizona motorists, having a gun in the car is a strong marker for aggressive and illegal behavior behind the wheel. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Firearms; Guns; Driving; Road rage; Aggression; Car; Automobile

1. Introduction

We live in a nation where over 8 million individuals carry guns in their vehicle each month (Hemenway and Azrael, 1997) and where 5 million handguns are carried regularly in cars and trucks, mostly for protection (Cook and Ludwig, 1996). Given the prevalence of gun carrying on the road, it is not surprising that highly publicized accounts of roadway altercations escalating to gunfights make the news. Yet almost nothing is known about the actual incidence of violence on the road, let alone about the relationship between firearms and driving-related hostility. In fact, although an extensive literature exists on the role of demographic, behavioral and personality factors in traffic collisions, and on the relationship between traffic conditions and driver stress and aggression (Conger et al., 1959; Hennessy

and Weisenthal, 1999; Hilakivi et al., 1989; McGuire, 1972; McGuire, 1976; O’Neill, 1996; Tsuang et al., 1985; Brewer, 2000), the context in which hostile driving-related behavior occurs remains largely unexplored (Brewer, 2000).

We discovered only a single empirical study in the academic literature about fatal ‘road rage’, defined by the National Highway Traffic Safety Administration (NHTSA) as a fatality resulting from ‘assault with a motor vehicle or other dangerous weapon by the operator or passenger(s) of one motor vehicle on the operator or passenger(s) of another motor vehicle precipitated by an incident which occurred on the roadway’ (NHTSA, 2001). In this study of five fatal incidents, alcohol intoxication was present in four of five cases, two deaths resulted from vehicular homicide, two victims were killed by gunshot at close range, and one elderly man died from a heart attack (Batten et al., 2000).

Little more is known about non-fatal rage on the roadway. One of the few empirical studies of the expression of anger on the road found that tendency to

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express anger toward other drivers was associated with dangerous and illegal driving—such as running red lights, speeding, driving drunk and non-fatal car crashes (Hemenway and Solnick, 1993). Although some studies suggest that illegal driving is associated with firearm possession (Miller et al., 1999) and that being arrested for a non-traffic offense is more likely among those who carry guns in their vehicle (Cook and Ludwig, 1996), no study to date has directly linked firearm carrying to hostile behavior behind the wheel. In fact, the only published survey we could discover about both firearms and non-fatal aggression on the road found that 19% of college students in urban Las Vegas feared being shot at by another driver and 5% carried a gun while driving (Rasmussen et al., 2000).

The present study, based on a random sample of Arizona motorists, provides what we believe is the first direct exploration of the relationship between aggression on the roadway and firearm carrying among drivers. It also provides new evidence about other behavioral and demographic characteristics that are related to aggressive and illegal driving in a state with one of the highest firearm injury rates in the nation (NCHS, 1998). For the purposes of this paper we adopt a broad definition ‘road rage’ which encompasses aggressive behavior by the operator (or passenger) of one motor vehicle towards the operator (or passenger) of another motor vehicle on the roadway.

2. Methods

Data come from the Grand Canyon State Poll, a random-digit-dial telephone survey of licensed drivers in Arizona, conducted by the Social Research Laboratory at Northern Arizona University between 2–10 October 1999. Calls were made between 09:00 and 21:00 h, Monday through Friday; 10:00–18:00 h, Saturday; and 13:00–21:00 h Sunday. Telephone numbers were randomly generated to include households with listed, unlisted and newly established numbers. The random-digit-dial technique ensured that all households with a single telephone line had an equal, unbiased probability of inclusion. Households with more than one telephone line were more likely to be selected than households with a single line; households without a telephone were not included.

Once a telephone number had been randomly selected for inclusion in the survey sample, up to 15 callbacks were placed to each household determined to be eligible. These callbacks were made in response to receiving busy signals, answering machines and no answers. Within households the adult with the most recent birthday was selected. Respondents were told that all their answers were completely confidential and that neither names nor addresses would be recorded. All interviews were conducted in English.

Of the 6219 telephone numbers that were randomly selected, calls to 1411 yielded contact with households that were determined to be eligible for the survey; 2383 numbers were ineligible because they were not working or were not residential, and the eligibility of 2425 was not known (e.g. because there was no answer). Of the 1411 eligible households, 556 declined to participate; 855 households were thus eligible and completed the survey (response rate = 61% using Aday, 1996, pp. 166).

Of the 855 adults selected (one from each of the randomly selected households), 94% (799) said they were licensed drivers. Of the 799 licensed drivers, 790 answered questions about aggressive and rude driving behavior. Results presented derive from analyses of these 790 individuals. Sample proportions were calculated using the 1990 Census.

No more than one adult from each household was interviewed. As a result, an adult in a single adult household was more likely to be interviewed than a given adult in a household with more than one adult. The sample is thus a representative sample of households, not of individuals. Since single adult households headed by women outnumber those headed by men, sampling of women increases when randomization takes place at the household level. Consequently, the survey includes more women (58%) than men (42%). Weighting by gender (giving males more weight) increased estimates of aggressive driving behavior and gun ownership but did not affect our analysis of risk factors. For simplicity of exposition, we present the unweighted data.

The demographic composition of our sample is fairly similar to that of the adult population in Arizona as described by the 2000 US Census, though our survey contains more women (as mentioned) and household incomes in our sample are higher than in the general Arizona population. In our sample, 7% of households had incomes under \$10 000 (vs. 15% in the general Arizona population); 58% had incomes between \$10 000 and \$50 000 (vs. 64%); 28% had incomes between \$50 000 and \$100 000 (vs. 17%) and 7% had incomes over \$100 000 (vs. 3%). The age and racial distributions in our survey are similar to that of the general population in Arizona, though fewer members of our sample (compared to the general adult population) identified themselves as Hispanic/Spanish or Latino origin. In our sample, 12% were 18–24 years old (vs. 15% in the general population); 67% were 25–64 years old (vs. 66% in the general population); and 21% were 65 year or older (vs. 19% of the general population). Our sample consisted of 4% American Indians (vs. 4% in Arizona’s general population); 1% Asian (vs. 2%); 2% were African American (vs. 3%); and 81% whites (vs. 76%). In our sample (14%) identified themselves as Hispanic/Spanish or Latino origin (vs. 21% of the general Arizona population).

The primary outcome of interest in multivariable estimates was whether the respondent engaged in at least three out of four rude or aggressive driving behaviors over the 12 months prior to the survey. These four rude/aggressive behaviors were whether the respondent had, in anger, (1) made obscene or rude gestures at another driver; (2) cursed or shouted at another driver; (3) impeded another drivers progress with their vehicle; or (4) aggressively followed another vehicle too closely. Information was collected on age as a continuous variable and parsed into three subgroups (18–34 years of age; 35–59 years of age; 60 and older); gender; race (dichotomized as white or other); education (collected at nine levels of educational attainment and dichotomized as some college vs never in college); marital status (married/living with an intimate vs. single/divorced/widowed); annual family income (collected in nine categories and dichotomized as > \$50 000 vs. below); and driving frequency (every day, 2–3 times per week, once a week, less than weekly).

Respondents were also asked whether, in the 12 months prior to the survey, they carried a gun while driving and if so, whether they always carried or only sometimes carried a gun and whether the gun was loaded. If they ever carried they were asked (1) whether they carry a pistol or a rifle or both and (2) if the gun was ever loaded while in their car. In addition, respondents were asked if they, in anger, had personally brandished a gun at another driver and whether, as motorists, they had been victims of the above mentioned aggressive behaviors over the previous year. We created a missing income variable for individuals who did not estimate their income.

Bivariate analysis used the χ^2 test for significant differences in discrete independent variables to explore the relationship between dependent and independent variables. χ^2 tests for linear trend were used to assess associations between independent variables across our trichotomized dependent variable (never vs. sometimes vs. always carrying a firearm in one's vehicle). In multivariate analyses, logistic regression was used to assess associations between demographic and behavioral characteristics and our dependent variable, while taking into account several potential confounders.

Age, income and educational attainment were parsed based on cell size considerations and on what seemed substantively sensible subdivisions. Of note, our findings were not materially altered when we specified age as a continuous variable nor when we specified income and educational attainment in a more finely stratified fashion.

3. Results

Thirty-four percent of our drivers reported having

made obscene gestures or cursing at other drivers over the 12 months prior to the survey. Twenty-eight percent reported aggressively following or blocking other drivers with their vehicle; 7% reported engaging in at least three of these four behaviors (Table 1). Eighty-seven percent of our drivers reported driving at least daily; an additional 10% reported driving at least twice a week (Table 1).

In both crude and multivariate adjusted analyses, having engaged in rude and hostile behavior while driving were significantly more common among men, among young adults, and among individuals who carried a firearm in their car. Driving frequency, race, education, marital status and income were not associated with rude or aggressive driving behavior (Tables 1 and 2).

Compared to women drivers and to drivers who never drove with a gun, respectively, men and individuals who drove with a gun in their car were approximately three times as likely to report engaging in at least three of the four rude and aggressive behaviors on our survey (Table 2). Overall 11% of drivers (7% of women and 17% of men) always (4%) or sometimes (7%) carried a gun with them in their car (Table 3). Eighty-three percent (73/87) of drivers who carried a gun carried a handgun (not shown). Among drivers who carried guns in their car, those who always carried a gun in their car had higher rates of making obscene gestures, cursing, tailgating or blocking other drivers than those who sometimes carried a gun (Table 3).

Of the 17% (57) of men who carried a gun in their car, 76% always carried their gun loaded and an additional 13% sometimes carried a loaded gun. Of the 7% (30) of women who carried a gun in their car, 77% always or sometimes carried their gun loaded (not shown). Individuals who drove with loaded guns were no more likely to have reported acting in a rude or aggressive manner while driving than were those who drove with unloaded guns (not shown). Fewer than 1% (4/790) of drivers reported ever threatening another driver with a gun (Table 4).

Self-reported aggressive behavior behind the wheel was also associated with reporting that other drivers behave aggressively (Table 4). For example, of the 413 respondents who reported cursing or making obscene gestures at other drivers, 70% reported being on the receiving end of such behavior, compared to only 42% of respondents who reported refraining from such behavior themselves, $P < 0.001$ (Table 4). Similarly, of the 211 respondents who reported aggressively following or blocking another driver with their vehicle, 96% reported being on the receiving end of such behavior, compared to 81% of respondents refraining from such behaviors themselves, $P < 0.001$. Overall, those drivers who en-

gaged in rude and aggressive behavior were more likely to report being victimized by such behavior (Table 4).

Two and a half percent (19/790) of respondents reported being victimized by another driver with a gun (Table 4). Nine percent (8/87) of respondents who carried a gun in their vehicle (compared to 2% of non-gun carriers) reported having been threatened with

a gun by another driver over the previous year, $P < 0.001$ (Table 4). While carrying a gun in one's vehicle was associated with engaging in aggressive and rude behavior (Tables 1 and 2) and with being threatened with a gun by another driver (Table 4), carrying was not strongly associated with non-gun victimization (Table 4).

Table 1

Respondent characteristics: percent of respondents who engage in rude and hostile behavior directed at other drivers

	N	% respondents who made obscene gestures or cursed/shouted angrily at other drivers within the last year	% respondents who aggressively followed or blocked other drivers within the last year	% respondents who engaged in at least three of the following: made obscene gestures, cursed/shouted angrily at, aggressively followed or blocked other driver within the last year
Overall	790	34	28	7
<i>Gender</i>				
Men	335	42***	36***	11***
Women	449	27	21	4
<i>Age</i>				
18–34 years	195	54***	45***	16***
35–59 years	346	33***	26***	4***
60+	183	14	11	1
Age missing	66			
<i>Race</i>				
White	644	33	27	6
Non-white	141	38	32	10
<i>Education</i>				
Less than College	186	35	20~	7
College	589	33	26	6
<i>Marital status</i>				
Married/living with intimate	470	34	26	6
Single/divorced/widowed	299	34	26	7
<i>Income</i>				
≥\$50 000	237	35	30	7
<\$50 000	392	37	23	6
Income missing	161			
<i>Driving frequency</i>				
Every day	685	6	28	7
2–3 times a week	77	22	16	3
Once a week	12	17	25	8
Less than weekly	14	17	14	7
<i>Gun carrying in vehicle</i>				
Always or sometimes	87	48**	37*	17***
Never carry a gun	697	32	26	5
<i>Respondent been the victim of another's gun brandishing while driving</i>				
Yes	19	74**	52**	31***
No	770	33	26	6

χ^2 test is to used to test for significant differences in discrete independent variables *** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$; ~ $P < 0.01$.

Table 2

Demographic and behavioral characteristics of Arizona drivers who report engaging in rude, hostile and frankly illegal behavior directed at other motorists on the roadway

<i>Gender</i>	
Men	2.7 (1.4,5.3)**
Women	
<i>Age</i>	
18–34 years	32.1 (4.2, 245.7)**
35–59 years	6.7 (0.8, 53.3)
60+	Reference group
Age missing	
<i>Race</i>	
White	1.1 (0.9,1.3)
Non-white	
<i>Education</i>	
Less than college	1.1 (0.5,2.4)
College	
<i>Marital Status</i>	
Married/living with intimate	
Single/divorced/widowed	1.0 (0.5,1.9)
<i>Income</i>	
≥ \$50,000	1.0 (0.5,1.9)
< \$50,000	Reference group
<i>Income missing</i>	
<i>Driving frequency</i>	
Every day	1.2 (0.1, 10.7)
2–3 times a week	1.2 (0.1, 16.0)
Once a week	1.5 (0.1, 32.3)
Less than weekly	Reference group
<i>Gun carrying in vehicle</i>	
Always or sometimes	3.2 (1.5, 6.9)**
Never carry a gun	
<i>Respondent been the victim of another's gun brandishing while driving</i>	
Yes	2.6 (0.8, 8.5)
No	

Multivariable Odds Ratio (95% CI) for reporting having engaged in three or more of the following behaviors, aimed at other drivers, within the last year: (1) made obscene gestures at another driver; (2) cursed or shouted angrily at another driver; (3) aggressively followed another's vehicle too closely; (4) aggressively blocked another's vehicle with their car. In Multivariate analyses, logistic regression is used to assess associations between aggressive/rude driving behavior and selected demographic and behavioral characteristics. *** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$; ~ $P < 0.1$.

4. Discussion

Most studies find an association between aggressive driving behavior and male sex, youth, alcohol or drug use, being unmarried, smoking, aggressive personality type, stressors at home, at work and in the driving environment (Deery and Fildes, 1999; DiFranza et al., 1986; Evans, 1991; Holzapfel, 1995; Jonah, 1990, 1997; McMurray, 1970; Sivak, 1983). Consistent with previous work, we find that hostile, aggressive and rude driving behavior is highest among drivers who are

young and male. In addition, we find that hostile behavior behind the wheel is strongly associated with carrying a firearm in the car, even after controlling for age, gender, driving frequency, race, education, income, marital status and history of firearm victimization on the road.

Younger drivers in our study were more likely than older drivers to report angrily and aggressively following another vehicle, cursing/gesturing/shouting in anger at another vehicle, or frankly blocking another car's progress with their vehicle (Table 1). These findings persisted even after controlling for driving frequency.

Similarly, even after controlling for increased driving exposure among men, we find that men are more likely than women are to engage in hostile behavior aimed at other drivers (Table 1). This result is consistent with previous work that found male drivers were more likely than female drivers to speed and drive while intoxicated (Hemenway and Solnick, 1993), even after controlling for increased driving exposure among men. It is possible that some of the gender related differences we report are related to the fact that men are consistently overrepresented among drivers who drink (Anda et al., 1987; Bradstock et al., 1987; Hemenway and Solnick, 1993; Richman, 1985). Unfortunately, we do not have information about alcohol intake or drinking while driving and, therefore, can not estimate the extent to which alcohol may be responsible for the gender-related differences we observe. Nevertheless, since other studies that have controlled for alcohol intake see a persistent relationship between dangerous and illegal driving and male sex (Hemenway and Solnick, 1993), it is likely that some gender-related differences would persist in our study as well.

National estimates of gun carrying in vehicles come from two recent surveys, one of which found that 4% of Americans carried a firearm in their vehicle over the previous 30 days (Hemenway and Azrael, 1997). The other survey found that at least 7.7% of the adult population usually kept a firearm in their car (Cook and Ludwig, 1996). In our survey, 11% of Arizona drivers reported carrying a gun in their vehicle over the previous year (7% of women and 17% of men). Compared to other Arizona drivers, drivers who carried a gun in their car were three times as likely to report engaging in several rude, hostile and illegal driving behaviors (Table 1). The relationship between guns and hostile driving behavior persisted after controlling for gender, age, driving frequency, race, education, income, marital status and history of firearm victimization on the road. Our finding that individuals who carry guns while driving are also more likely to violate traffic laws (e.g. aggressively following or blocking another car) is consistent with a study that found gun carrying among adolescents is associated with aggressive and delinquent behavior (Hemenway et al., 1996; Webster et al., 2001).

We do not know why drivers who carry guns are more likely to act in a hostile manner in their car. Three of the possibilities are (1) that those who are disposed to carry are also disposed to engage in hostile behavior, (2) that having a gun in the car emboldens drivers to act more aggressively than they otherwise would, and (3) where rates of hostile encounters are higher, drivers are more likely to carry guns for protection “and also may have more reason for an angry response”. Our data do not allow us to determine which of these is likely to have the greatest explanatory power. We also lack direct information about why our drivers carried guns. In other studies, however, protection has been the predominant reason given for gun carrying both on one’s person and in a vehicle (Cook and Ludwig, 1996; Hemenway and Azrael, 1997; Hemenway et al., 1996). We suspect most respondents who are carrying do so for protection — 2/3 carry their guns loaded and 3/4 carry a handgun.

Respondents who reported engaging in aggressive behavior behind the wheel were more likely to report that other drivers behaved aggressively against them on the road (Table 4). From our data we can not tell whether hostile drivers tend to have an exaggerated perception of other’s aggressiveness or whether aggressive drivers accurately depict the hostile environments in which they tend to drive. Furthermore, even if aggressive drivers objectively categorize the hostile behavior of motorists with whom they have contact, we can not tell whether the respondent’s own aggressive behavior instigated or retaliated against others’ aggressive and rude behavior. In fact, if there is a retaliatory component to respondent’s aggression, we can not tell whether this finding reflects individual-level reciprocal antagonism: a respondent’s aggressive behavior could be directed at individuals who directly threaten them or it could be a generalized response to having been victimized. Unfortunately, our data do not address these issues.

Probably the most important limitation of our study is that data come from self-report. Self-report data are subject to potential inaccuracies due to social desirabil-

ity responses, recall bias, intentional distortions or non-candid responses (Aday, 1996; Kellermann et al., 1990). Nevertheless, this research approach has been rigorously applied in the field of automotive and firearm research (DiFranza et al., 1986; Hilakivi et al., 1989; Kellermann et al., 1990; Panek et al., 1978; Parker et al., 1992; Suchman, 1970). In fact, self reported crash information is often more reliable than police, state, or insurance data (Panek et al., 1978). In addition, although self-presentation bias may decrease self reported aggressive driving behavior, the robust association we find between gun carrying and aggressive and illegal behavior behind the wheel would not, on this account, be biased unless self-report of aggressive/rude behavior differed markedly by gun carrying status.

Our data on exposure lack precision. Information is not available on the actual number of miles driven or the types or locations of the roads. Respondents were asked how many times a week they drove but not how many miles or hours per week; our exposure measure is just a crude estimate. Yet we do know that within each of the four driving frequency strata, rude and hostile behavior remained strongly associated with age, gender and gun carrying (not shown). In addition, we know whether a driver reported engaging in hostile behavior behind the wheel, not how often.

Another limitation is that although we include several potential confounders previously linked to aggression on the road and to household firearm ownership, many additional characteristics are likely to affect driver hostility and aggression (e.g. life crisis, traffic congestion). It is not clear, however, whether accounting for these unobserved characteristics would revise the magnitude of our observed association upward or downward. We also lack information about the intensity of hostility expressed and do not know whether armed confrontations between drivers are likely to thwart or to exacerbate fatal and non-fatal injuries on the road. As with all telephone surveys, ours is subject to sampling error (± 3.5 at the 95% confidence level for each question due to chance alone) and to systematic error (Frey 1989), such as under-representing individu-

Table 3

Self-reported rude and aggressive behavior behind the wheel among individuals according to whether they always, sometimes, or never carry a firearm while driving

Road rage	Always carry a gun (<i>n</i> = 35) (%)	Sometimes carry (<i>n</i> = 52) (%)	Never carry (<i>n</i> = 697) (%)
<i>% of drivers who</i>			
Make obscene gestures***	43	21	13
Curse at other drivers**	46	37	27
Aggressively follow other drivers**	40	25	21
Block other drivers*	17	12	8
Engage in three or more of the above behaviors***	27	12	5

χ^2 test for linear trend: *** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$.

Table 4
Associations between perpetration, victimization and gun carrying on the roadway

	% reporting another driver threatened them with a gun	% reporting another driver cursed/shouted angrily at them	% reporting another driver made obscene gestures at them	% reporting another driver aggressively followed them too closely	% reporting another driver aggressively blocked their vehicle	% reporting another driver cursed/shouted angrily or made obscene gestures at them	% reporting another driver aggressively followed or blocked them
Overall (n = 790)	2.5	44	44	81	39	57	85
<i>Respondent threatened another driver with a gun</i>							
Yes (n = 4)	50***	75	75	75	75	75	75
No (n = 782)	2	44	44	81	38	57	85
<i>Respondent cursed/shouted angrily at another driver</i>							
Yes (n = 228)	5***	69***	64***	89***	55***	79***	93***
No (n = 555)	1	34	36	77	32	48	82
<i>Respondent made obscene gestures at another driver</i>							
Yes (n = 121)	9***	70***	76***	88***	59***	83***	89*
No (n = 664)	1	39	38	79	35	52	85
<i>Respondent aggressively followed another driver too closely</i>							
Yes (n = 177)	5*	51*	57***	93***	60	66**	96**
No (n = 599)	2	42	40	76	32	54	82
<i>Respondent aggressively blocked another driver with their vehicle</i>							
Yes (n = 71)	8**	52	56*	90*	80***	69*	96**
No (n = 700)	2	44	43	80	34	56	84
<i>Respondent cursed/shouted angrily/made obscene gestures at another driver</i>							
Yes (n = 413)	4**	57***	56***	85**	51***	70***	90***
No (n = 376)	1	30	31	75	25	42	80
<i>Respondent aggressively followed/blocked another driver with their vehicle</i>							
Yes (n = 211)	5	50*	54***	92***	63***	65**	96***
No (n = 578)	2	42	40	76	30	54	81
<i>Respondent sometimes or always carries a gun his/her vehicle</i>							
Yes (n = 87)	9***	52	48	86	49	60	90
No (n = 697)	2	43	43	80	37	56	85

als without telephones (who are generally poor) (Lavrakas, 1987), and institutionalized criminals (Cook, 1985).

Despite these limitations, our findings suggest that gender, youth, and carrying a gun in a vehicle strongly predict which drivers are likely to behave aggressively toward other drivers by making obscene gestures, cursing or shouting, impeding another drivers progress with their vehicle or deliberately tailgating. Contrary to some claims, an armed society does not appear to be a more polite society. Rather, at least among Arizona motorists, having a gun in the car is a strong marker for what is sometimes labeled ‘road rage’, anger leading to rude, aggressive and dangerously illegal behavior behind the wheel.

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